ST. JOSEPH'S COLLEGE (AUTONOMOUS)

IRINJALAKUDA

CURRICULA AND SYLLABI FOR

M.Sc. GENERAL BIOTECHNOLOGY

Under Choice Based Credit & Semester System

2019 Admissions

SEMESTER- WISE COURSE TITLES, DURATION OF THEORY AND LABORATORY EXERCISES FOR EACH COURSE AND CREDITS

Semester – 1

COURSE CODE	COURSE TITLE	CREDITS
SJGBT 1C 01	Cell Biology	5
SJGBT 1C 02	Biomolecules	4
SJGBT 1C 03	Microbiology	4
SJGBT 1L 01	Laboratory – I (Cell Biology, Biomolecules and Microbiology)	5
SJGBT 1A 01	Classical / Benchmark papers – Presentation and critical analysis (AEC – Ability Enhancement Course)	4
	TOTAL	**18+4**

Semester – II

COURSE CODE	COURSE TITLE	CREDITS
SJGBT 2C 01	Metabolism and Basic Enzymology	4
SJGBT 2C 02	Molecular Biology	5
SJGBT 2C 03	Environmental Biotechnology	4
SJGBT 2C 04	Biostatistics & Bioinformatics	4
SJGBT 2L 01	Laboratory – II (Metabolism & Basic Enzymology, Molecular Biology and Environmental Biotechnology)	5
SJGBT 2A 01	Application of statistical software such as SPSS – capabilities, data entry, choosing statistical tests, interpretation and analysis of data output. (PCC – Professional Competency Course)	4
	TOTAL	**22+4**

Semester – III

COURSE CODE	COURSE TITLE	CREDITS
SJGBT 3C 01	Genetic Engineering	4
SJGBT 3C 02	Bioprocess Technology	4
SJGBT 3C 03	Plant Biotechnology	4
SJGBT 3C 04	Immunology	4
SJGBT 3E 01	Stem Cell Biology Part A (Option I)	4
SJGBT 3E 02	Virology Part A (Option II)	
SJGBT 3L 01	Laboratory – III (Genetic Engineering, Bioprocess Technology, Plant Biotechnology and immunology)	4
	Total	**24**

*The students should select any one of the the elective paper-stem cell biology part A or Virology partA

Semester – IV

COURSE CODE	COURSE TITLE	CREDITS
SJGBT 4P 01	Project Work (Dissertation format – Introduction with aims and objectives, Literature review, Materials and methods, Results and Discussion, Conclusions and Future prospective)	5
SJGBT 4V 01	Comprehensive Viva-Voce	3
SJGBT 4E 03	Stem Cell Biology Part B	4
SJGBT 4E 04	Virology Part B	
SJGBT 4E 05	Industrial & Food Biotechnology	4
SJGBT 4E 06	Nanobiotechnology	
	Total	**16**

* The students should select any two of the four electives given in IVth semester. Students who have opted for stem cell biology part A in third semester should select Stem cell part B and those who have selected viorology part A in third semester should select virology part B in fourth semester. in addition they have to select one more elective paper ,either industrial food biotechnology or Nano biotechnology.

Total credits : 22 +26+ 24+16 = 88

SJ GBT1C01

CELL BIOLOGY

CO1- Understand the basics of the biology of the cell and principle of microscopic techniques

CO2- Compare the structural organization of prokaryotic and eukaryotic cells

CO3- Understand the mechanism of cell cycle to regulate cell division, apoptosis and cancer

CO4- Explain the synthesis of proteins, post translational modifications and folding of protein

CO5- Analyze the process of transport of molecules across cell compartments

CO6- Understand the concept of cell-cell interactions in plants and animals

CO7- Compare mechanism of different cell signaling pathways

CO8- Understand the mechanism of cellular energy transactions in mitochondria and chloroplast

SJ GBT1C02

BIOMOLECULES

CO1- Understand the basic knowledge and concepts about biochemistry and various biomolecules

CO2- Discuss the classification, structure and functions of various biomolecules in cells

CO3- Discuss the classification, structure and functions of vitamins and hormones

CO4- Understand Heterocyclic compounds

CO5- Explain the separation techniques such as chromatography techniques,electrophoresis , centrifugation techniques and spectrophotometer to separate products and purification.

CO6- Explain the analytical techniques and advanced bioinstrumentation techniques

SJ GBT 1C 03

MICROBIOLOGY

CO1- Discuss the historical background of microbiology

CO2- Understand the major concept of identification, cultivation, classification of microorganisms

CO3- Discuss different microscopic and sterilization methods used in microbiology

CO4- Explain the major concept of microbial metabolism

CO5- Describe the microbial interactions and their overall effects to biosphere.

CO6- Understand the importance of antimicrobial agents ,their classification and mechanism of toxicity

SJ GBT 2C 01

METABOLISM AND BASIC ENZYMOLOGY

CO1- Understand the basic concept of complexity, key reactions, regulation and evolution of metabolic pathways

CO2- Understand the concept of standard free energy and evaluate the role of high energy and low energy phosphate compounds in biological oxidation-reduction reactions.

CO3- Discuss the metabolic pathways involved in the synthesis and degradation of carbohydrates, lipids, amino acids and nucleic acids.

CO4- Illustrate the functional aspects of electron transport systems in mitochondria and chloroplast

CO5- Understand mechanism and factors affecting of enzyme action, expression of enzyme activity and immobilisation of enzyme.

CO6- Evaluate the methods for determining the kinetic behaviour of enzyme and analyse the regulatory patterns of activation and inhibition.

SJ GBT 2C 02

MOLECULAR BIOLOGY

CO1-Understand the basic structure and concepts of molecular biology and related concepts

CO2-Analyze the concept and mechanism of DNA Damage and Mutation with reference to DNA repair system is taught

CO3- Understand about the fine structure and features of gene and to get understand the major mechanisms involved in gene transfer.

CO4- Discuss the molecular mechanism and machineries involved in replication,transcription,and translation .

CO5- Discuss the significance of operon models, plasmids and Transposons in the living system.

CO6- Explain the concept of Central Dogma and importance of the universal Genetic code and its features.

CO7- Define the molecular aspects of cancer such as genes involved in cancer

SJ GBT 2C 03

ENVIRONMENTAL BIOTECHNOLOGY

CO1- Understand the basic concept and issues of environmental Biotechnology and different types of pollution's and their management.

CO2- Evaluate importance of Biodiversity and their measurement

CO3- Determine biological methods for identification and treatment of different pollution and polluted areas

CO4- Explain the microbial involvement in the degradation of toxic products and protection of environment.

CO5- Demonstrate production of economically important substance from biological sources

CO6- Significance of global environmental issues and the control measures.

SJ GBT 2C 04

BIOSTATISTICS AND BIOINFORMATICS

CO1-Analyse statistical data using measures of central tendency dispersion, MS Excel, MS Word and location

CO2-Calculate and interrupt the correlation between two variables and simple linear regression equation for a set of data

CO3-Analyse statistical data graphically using frequency distributions and cumulative frequency distributions

CO4-Understand data organization and management of data

CO5-Understand the basic concept of bio informatics, including Data management, sequencing, protein modelling and phylogeny.

SJ GBT 3C 01

GENETIC ENGINEERING

CO1-Understand the basic principle, tools, cloning vectors used and transformation strategies followed in genetic engineering experiments

CO2-Create gene libraries and understand the methods of selection and screening of recombinant clones

CO3-Discuss different prokaryotic and eukaryotic gene expression systems

CO4-Understand the application of molecular markers in genome mapping

CO5-Discuss the techniques of gene knockout and transgenic technologies, gene editing, gene correction and regulation

CO6-Understand the guidelines for genetic engineering experiments and biosafety and analyse general concerns and environmental hazards of genetic engineering

SJ GBT 3C 02

BIOPROCESS TECHNOLOGY

CO1-Discuss the use of living organisms in bioprocess technology, engineering, medicine and agriculture

CO2-Understand the major concept of bioprocess technology, bio reactor designing, media formulation and optimization

CO3-Explain the kinetics of microbial growth in different culture systems

CO4-Describe various parameters used for the measurement and control of bioprocess techniques

CO5-Explain the downstream process for fermentation products

CO6-Design a fermentation process for the production of microbial metabolite.

SJ GBT 3C 03

PLANT BIOTECHNOLOGY

CO1-Explain the basic concepts, sterile practices and maintenances of a tissue culture lab

CO2-Define molecular farming, plant tissue culture, embryogenesis and protoplast culture

CO3-Explain secondary metabolite production and its applications also describe the role of plant as a bioreactor

CO4-Describe the various techniques and vectors involved in plant transformation

CO5-Discuss about the GM crops and their products

SJ GBT 3C 04

IMMUNOLOGY

CO1- Understand the major aspects of immune system.

CO2- Discuss the properties of antigen and antibodies and mechanism of their interactions.

CO3- Significance of MHC, T-cell, B-cell receptors and their regulations.

CO4- Explain hypersensitivity, autoimmunity and their treatment process
CO5- Understand basic concept of immunity against infectious agents and transplantation process.

CO6- Describe the mechanism of tumor development and therapeutic techniques against cancer

CO6-Understand the strategies for the improvement of crops and yields

SJ GBT1L01

LABORATORY 1- CELL BIOLOGY, BIOMOLECULES & BIOPHYSICS AND MICROBIOLOGY

CO1- Demonstrate the basic microbiology handling techniques like sterilization and media preparation

CO2- Describe about staining and slide preparation techniques

CO3- Demonstrate various separation techniques such as chromatography techniques, electrophoresis, centrifugation techniques and spectrophotometer

CO4- Understand the reactions of amino acid, sugar and lipids

CO5- Discuss about different microscope principles and to be well versed with the handling of microscope

CO6- Understand the cell division principle and its various stages and to determine the presence of Barr body

CO7- Determine the Anti-Microbial Activity by different methods and to analyse the bacteriological water quality

SJ GBT2L01

LABORATORY II- METABOLISM & BASIC ENZYMOLOGY, MOLECULAR BIOLOGY AND ENVIRONMENTAL BIO TECHNOLOGY.

CO1-Design an experiment for the extraction and purification of enzyme

CO2-Understand the principles of basic molecular and biochemical techniques

CO3-Evaluate enzyme activity using assay protocols

CO4-Analyse the factors affecting enzyme activity

CO5-Discuss the techniques for the estimation of water quality, nitrate content, water pollution parameters BOD, COD

CO6-Understand the concept of buffer preparation, isolation and quantification of nucleic acids and restriction –ligation experiments

SJ GBT 3L 01
LABORATORY III- GENETIC ENGINEERING, BIO PROCESS TECHNOLOGY, PLANT BIOTECHNOLOGY AND IMMUNOLOGY.

CO1-Design transformation experiment

CO2-Understand DNA amplification using PCR and Blotting techniques

CO3-Design small scale production unit of ethanol, organic acid, enzymes and antibiotics

CO4-Understand the technique of Whole cell immobilization

CO5-Demonstrate callus initiation and organogenesis in different plantlets

CO6-Comprehensive understanding of basic immunological principles

SJ GBT 4P 01

PROJECT WORK

CO 1- Build strong practical skills in advanced areas of biotechnology.

CO 2- Develop the aptitude to work on scientific problem and look for alternative solutions.

CO 3- Understand the concept of computational analysis and research methodology.

CO 4- Create proficiency in literature writing and research.

SJ GBT 3E 01
Stem Cell Biology (PART – A)

CO1-Define the basic terminology in stem cells

CO2-Understand the Sources and classification of stem cells

SJ GBT 4E 03
Stem Cell Biology (PART – B)

CO1-Discuss Neurodegenerative diseases and Application of stem cells in therapy

CO2-Analyse the concept of human embryonic stem Cells with reference to ethical and religious consideration

CO3-Examine various model organisms in the field of stem cell research

CO4-Understand Stem cell isolation & characterization techniques

SJ GBT 3E 02
Virology (Part A)

CO1-Understand the basic concept of isolation, cultivation, classification and enumeration of viruses.

CO2-Explain viral tropism and replication mechanism of viruses

CO3-Describe virus host interactions

SJ GBT 4E 04
Virology (Part B)

CO1-Describe about different types of virus and their control measures.

CO2-Explain different types of bacteriophages

CO3-Determine the economic losses due to virus

CO4-Discuss about various viral detection and enumeration techniques.

SJ GBT 4E 05
Industrial & Food Bio Technology

CO1-Understand the historical aspects and applications of bioprocess and biotechnology in food processing

CO2-Analyse the commercial use of different microorganisms and microbial enzymes in fermentation and food processing

CO3-Discuss the strain improvement strategies of microbes for the production of food processing enzymes

CO4-Understand the applications of cell and enzyme immobilization, biosensors and bioprocess monitoring

SJ GBT 4E 06
Nanobiotechnology

CO1-Define Nano biotechnology and understand the basic concepts and applications of Nano biotechnology

CO2-Understand the concept of Molecular Nanobiotechnology

CO3-Analyse basic characterization techniques for nanoparticles

CO4-Understand the use of nanostructures for drug delivery, diagnostic purpose and construction of devices for sensor development

SJGBT 1A 01

Classical / Benchmark papers – Presentation and critical analysis (AEC – Ability Enhancement Course)

CO 1- Develop the ability to critical thinking and communication skill.

CO 2- Create research aptitude and proficiency in literature review.

SJGBT 2A 01

Application of statistical software such as SPSS-capabilities, data entry, choosing statistical tests, interpretation and analysis of data output. (PCC- Professional Competency Course).

CO 1- Create proficiency in statistical tools and data analysis.

CO 2- Create professional competency

****

Total credits excluding AEC and PCC courses = 80

SEMESTER-I

SJGBT 1C 01 - CELL BIOLOGY

1. Cells –diversity of cell size, shape and number, diversity in internal organization – cell theories. Sub cellular organisms Viruses, Prions. Microscopy – types and techniques.
2. Prokaryotic cells and eukaryotic cells- structure and organization. Cellular organelles, plasma membrane, cell wall, mitochondria, chloroplast, endoplasmic reticulum, chromosomes, nucleus, nucleolus and ribosome biogenesis and structural features, Golgi apparatus, lysosomes, microbodies, peroxisomes, cytoskeleton. Cell motility- cilia and flagella–organization and functions.
3. Cell growth and cell division- cancer, oncogenes and tumour suppressors, molecular events and model systems. Regulation of cell cycle- cell cycle checkpoints. Apoptosis – intrinsic and extrinsic pathways.
4. Biosynthesis of proteins in prokaryotes and eukaryotes. Co- and post translational modifications. Protein folding.
5. Transport of molecules across cell compartments. Transport across ER and Golgi vesicular trafficking. Protein delivery into peroxisomes, mitochondria and chloroplasts.
6. Cellular responses to environmental signals in plants and animals, principles and mechanisms of signal transduction, cell to cell interaction - extracellular matrix, interaction of cells with other cells, tight junctions, adherence, gap junctions, plasmodesmata.
7. Cellular energy transactions- role of mitochondria and chloroplast- oxidative metabolism in mitochondria, translocation of protons machinery of ATP formation.

References:

1. Molecular biology of cell – Alberts B et al
2. Molecular cell biology – Lodish et al
3. Cell and Molecular Biology: Concepts and Experiments - Gerald Karp and Nancy L Pruitt
4. Reproduction in eukaryotic cells – D M Prescott
5. Developmental biology – S F Gilbert, Sinauer Associates
6. Cell in development and inheritance – E B Wilson
7. The coiled spring – Ethan Bier
8. Fertilisation – F T Longo, Champan and Hall
9. Molecular biology of steroid and nuclear hormone receptors – L P Freedman

SJGBT 1C 02 - BIOMOLECULES

1. Chemical foundations of biology – Introduction to biomolecules, Molecular logic of Life, Energy transformations and Chemical reactions. weak bonds, covalent bonds, weak interactions in aqueous system, ionization of water, weak acids& bases, pH, pKa, Henderson-Hassel Balch equation, titration curves, buffers, buffer systems. Diffusion and osmosis.

2. Thermodynamics – Principles, enthalpy, entropy, free energy concept, standard free energy, thermodynamics governing biochemical systems.

3. Sugars – Classification, structure, function and chemical reaction, methods for compositional analysis of polysaccharides. Biosynthesis of Starch and Glycogen-UDP sugars.

4. Amino acids – Basic ideas about physiological functions of amino acids,Classification, structure, stereochemistry, physical & chemical properties. Biosynthesis Proteins – Classification, structural hierarchy, Ramachandran map, separation and purification, criteria of homogeneity, end group analysis,

5. Lipids–Classification, structure, functions, physical and chemical properties, Sphingolipids eicosanoids, separation & analysis of lipids. Bio-synthesis.

6. Nucleic acids – Nucleotide structure & function, nucleic acid structure & function. Bio-synthesis; Phosphoribosyl diphosphate - significance. Regulation of Biosynthesis.

7. Vitamins & Hormones – Classification, structure & physiological functions, Phytohormones.
8. Heterocyclic compounds – Secondary metabolites in living system, pigments, andIsoprenoids – mevalonate pathway.

9. Separation techniques – Chromatographic techniques, Electrophoresis and centrifugation techniques and spectrophotometer.

10. Analytical techniques – Analytical techniques in biochemistry & biophysics for small molecules and macro molecules for quantitation. X-ray crystallography & NMRspectroscopy of proteins Mass spectrometry of proteins-MALDI, ESI, MALDI-TOF.

References

1.Biochemical Calculations, Irwin H. Segel, John Wiley and sons Inc.
2. General Chemistry, Linus Pauling, W.H.Freeman & Company.
3. Organic Chemistry, DJ Cram and GS Hammond, McGraw Hill.
4. Biochemistry, D Voet and JG Voet, J Wiley and Sons.
5. Principles of Biochemistry, Lehninger. A.L., Nelson, D.L. and Cox, M.M, CBS Publishers and Distrubutors.
6. Biochemistry, Jeremy M.Berg, John L. Tymoczko and Lubert Stryer, W. H. Freeman & Company.
7. Physical Biochemistry, D Freifelder, W. H. Freeman & Company.
8. Laboratory Techniques in Biochemistry and Molecular Biology, Work and Work.
9. Understanding Chemistry, CNR Rao, Universities Press, Hyderabad.
10. A Biologist's Guide to Principles and Techniques of Practical Biochemistry. K. WilsonKH Goulding, ELBS Edition.
11. Tools of Biochemistry , T.G. Cooper.

SJGBT 1C 03 – MICROBIOLOGY

1. History of Microbiology, Discovery of microbial world, role of microbes in transformation of organic matter and in causation of disease. Microscopy – Light, Phase contrast, Fluorescent, Transmission electron microscope, Scanning electron microscope and scanning tunneling microscope, Confocal microscope, Atomic force microscope. Sterilization methods – Physical, Chemical and Biological
2. Pure Culture Concepts – Culture Media preparation; selective differential and enrichment media, Pure Culture Concepts, Microbial growth – different phases, measurement – Bacterial Growth Curve. Microbial Nutrition – Growth factors, Nutritional Classification of bacteria, uptake of nutrients
3. Diversity of Microbial World, Principles of Classification of microbes, approaches in bacterial taxonomy, Biology of Mycoplasmas, Microbial Staining- Grams, Differential, Motility determination
4. Introduction to Mycology – General characters of Fungi, Cultivation of Fungi, Cultural characters, Microscopic Morphology, Importance of Fungi in industry and Food production. Fungi as pathogen to man, animals and plants
5. Introduction to Virology Bacteriophages.– Discovery and structure, Baltimore Classification, Replication – Lytic and Lysogenic Cycles, Cultivation of Viruses. Detection and Enumeration of Viruses – Viral assay.
6. Microbial Metabolism – Glycolysis, Krebs Cycle, Glyoxylate Cycle, Entner Duodroff pathway, HMP shunt, ATP Synthesis, Aerobic and Anerobic respiration, Photo Synthesis, Fermentation, Methanogenesis,
7. Microflora of Soil – Rhizosphere, Biogeochemical cycles (Phosphorus, Oxygen, Nitrogen, Sulphur, Carbon), Plant Microbe interaction (symbiotic and asymbiotic). Biopesticides and Bioinsecticides. Microbiology of Air and Water- Dust, Droplets and droplet nuclei, Bacteriological examination of drinking water, waste water treatment and management (aerobic and anaerobic process.)
8. Microbes and Man - Saprophytes, Commensals, Pathogen. Sources of infection – Reservoirs, Carriers and Vectors. Congenital infections, Mode and source of infections,

pathogenesis and prophyllactic methods of following diseases – Cholera, Tuberculosis, Diphtheriae, Syphilis, Influenzae, Poliomyelitis, Malaria, Amoebiasis, Dermatomycosis.

9. Antimicrobial Agents, Antibiotics, chemotherapeutic agents, major classes and mechanism of action, minimal inhibitory concentration (MIC), Microbial Drug resistance.

References

1. Pelczar, M.J.Chan, ECS & Krieg - Text Book of Microbiology.
2. Fundamentals of Microbiology – Alcamo E.
3. Prescott, L.M., Harley J.P & D.A.Klein – Microbiology
4. Benson, H.J. – A Laboratory Mannual in General Microbiology.
5. Cappuccino, J.G. – Laboratory Mannual in Microbiology.

SJGBT 1L 01 – LABORATARY 1- CELL BIOLOGY, BIOMOLECULES AND MICROBIOLOGY

Cell Biology (Practicals)

1. Microscopy: Bright field, phase contrast and fluorescence microscopy
2. Microtomy
3. Mitosis and meiosis
4. Histochemical techniques
5. Observation of Barr body
6. Subcellular fractionation
7. Squash preparation- polytene chromosome
8. Karyotyping

Biomolecules (Practicals)

1. Titration of amino acids – Determination of pK and pI values.
2. Reactions of amino acids, sugars and lipids.
3. UV, visible & fluorescence spectroscopy, absorption spectra.
4. Quantitation of Sugars & Proteins.
5. Analysis of oils – iodine number, saponification number.

6. Chromatography (Gel permeation, Ion exchange, TLC)
7. Electrophoresis (PAGE, SDS-PAGE, Agarose)

Microbiology (Practicals)

Equipments – Hot air oven, Autoclave, Seitz and membrane filter, Microscopy.

1. Media Preparation – Nutrient broth and Nutrient Agar, Mac conkey Agar, Blood Agar, Potato Dextrose Agar, Yeast Extract Mannitol Agar.
2. Staining Techniques – Simple and Gram Staining, Spore and Capsule Staining, Fungal Staining, Acid Fast Staining.
4. Motility Determination – Hanging drop method.
5. Isolation of Pure Colonies of Bacteria – Streak, Spread and Pour Plate Methods.
6. Biochemical Tests – Indole Test, Methyl Red test, Voges Prauskaur test, Citrate Utilisation test, Triple Sugar Iron test
7. Cultivation Microscopic Examination of fungi *Penicillium*, *Aspergillus*
8. Bacteriological Analysis of Water – Presumptive, Confirmed and Completed tests (MPN).
9. Determination of Anti-Microbial Activity by Disc Diffusion method (Kirby Bauer Method), Determination of MIC by Tube Dilution Method.

SEMESTER-II

SJGBT 2C 01 METABOLISM AND BASIC ENZYMOLOGY

1. Introduction to Metabolism – Overview of metabolic pathways (carbohydrates, amino acids, lipids, nucleic acids), key reactions of metabolic pathways, regulation of metabolic pathways, evolution of metabolic pathways-RNA world.

2. Bioenergetics – Standard free energy concept, energy of activation, standard free energy, relationship between Standard free energy & equilibrium constant, energy coupled reactions in Metabolism, , high energy & low energy phosphate compounds, Biological oxidation- reduction reactions.

3. Carbohydrate Metabolism – Glycolytic pathway, Citric acid cycle, glycogenolysis, gluconeogenesis, pentose phosphate pathway.

4. Electron transport systems – Electron transport systems in mitochondria & chloroplast, alternate pathways, glyoxylate pathway, cyanide insensitive respiration.

5. Amino acid metabolism – Biosynthesis and degradation of amino acids, Urea cycle, overview of nitrogen metabolism, biosynthesis of proteins.

6. Lipid metabolism – Biosynthesis and Oxidation of fatty acids, phospholipids & glycolipid metabolism, biosynthesis of cholesterol.

7. Nucleic acid metabolism – Biosynthesis and degradation of purine, and pyrimidine nucleotides, General account of nucleic acid biosynthesis.

8. Enzymes – Classification and nomenclature of enzymes, Mechanism of enzyme action, Lock and key and induced fit hypothesis, factors influencing Enzyme activity, Isolation and purification of enzymes, Expression of enzyme activity, unit of activity, measurement of activity, Specific activity. Kinetics of enzyme, Km value determination – methods. Enzyme inhibition- types and the method for the determinations of inhibitor constants. Transition state analogs, Abzymes.

9. Mechanism of Enzyme Catalysis, Role of coenzymes and metals. Regulation of enzyme activity.. Allosterism, positive and negative modulations, zymogens, covalent modifications . Multienzyme complexes, compartmentation of enzymes, Isozymes, Immobilized enzymes, Enzyme engineering. Applications of Enzymatic analysis in medicine and industry.

References

Lehninger, A.L., Nelson, D.L. and Cox, M.M. Principles of Biochemistry. CBS Publishers and Distributors.

Voet, D. and J.G. Voet. Biochemistry, John Wiley & Sons, Inc.

Murray, R.K., D.K. Granner, P.A. Mayes and Rodwell V.W. Harper's Biochemistry: Appleton & Lange.

Gumport, R.I., Jonas, A. Mintel, R. and Rhodes C. Students companion for Stryer's Biochemistry. Freeman and Company.

Stumpf, P.K. and Conn, E.E. The Biochemistry of Plants. A comprehensive treatise (Series) Academic Press.

Gowenlock, A.H., McMurray, J.R. and McLauchlan, D.M. Practical Clinical Biochemistry. CBS Publishers & Distributors.

SJGBT 2C 02 MOLECULAR BIOLOGY

1. Molecular Basis of Life –Nucleic Acids and Polypeptides, Structure of DNA – Geneticmaterial, Chargaff's Rule, X-ray Crystallographic studies, Denaturation and Renaturation, super-coiling, Different forms of DNA, Circular DNA.

2. DNA Replication – General features; semi-conservative, Mechanism of Replication – Elongation and Termination, rolling circle and theta model, Enzymology of Replication – primase, DNA Polymerase, Gyrase, Topoisomerase, Helicase; Replication fork, Telomerase activity; Replication in cancer Cells.

3. DNA recombination and Repair – Mechanism, Proof-reading, Types of DNA damage, Types of DNA Repair; Mismatch, Base-excision, Nucleotide-excision, recombinational and direct repair, SOS repair, DNA recombination models and mechanisms – Holliday model (Homologous), D-loop, double-strand break, site-specific recombination and DNA transpositions, Transposable Elements in Prokaryotes and Eukaryotes, classification of Transposons, Mutations - Types and various mutagens.

4.Molecular Genetics - Molecular Mechanisms of Transformation,Transduction and Conjugation.

5. Gene Structure – Salient Features of Genes, Fine Structure of Prokaryotic and Eukaryotic Genes; Transcription – Mechanism in Prokaryotes, Types of Transcripts, EukaryoticTranscription, Post Transcriptional Modification of mRNA, mRNA Maturation, mRNA surveillance, Promoters and promoter elements.

6. RNA Splicing – Chemistry of Splicing, Spliceosome Machinery, Splicing Pathways, Modifications in RNA - 5'-cap Formation, 3' end Processing and Polyadenylation, RNA Processing, rRNA and tRNA processing, RNA Editing, Ribozymes.

7. Gene Regulation – Prokaryotic Gene Regulatory Mechanism; Operon Concept: Lac, trp, gal and ara operons. Gene Regulation in Eukaryotes, DNA methylations, Regulation of mRNA stability, Transcription Factors, Enhancers and Silencers.

8. Genetic Code – Salient Features, Deciphering the Code, Multiple Recognition of Codons and Wobble Hypothesis – Initiation and Termination Codon. tRNAs and their charging by amino-acyl transferases – chemical and kinetic proof-reading.

9. Proteins Synthesis Mechanism in Prokaryotes and Eukaryotes – Translation initiation, elongation and termination. Post Translational Modifications.

10. Biology of Cancer – Oncogenes and Tumour Suppressor Genes, Viral and Cellular Oncogenes, Tumour Suppressor Genes of Humans

References

1. Molecular Biology of the Genes – J.D.Watson, N.H.Hopkins
2. Moleculary Cell Biology, J.Darnell, H.Lodish
3. Genes XII – latest edition
4. Genomes, T.S.Brown
5. Molecular Cloning: a Laboratory Manual, J.Sambrook.

SJGBT 2C 03 - ENVIRONMENTAL BIOTECHNOLOGY

1. Environment - Basic concepts andissues.

2. Environment Pollution – Sources, types of pollution, Methods of Measurement of pollution. Air Pollution, sources and controlmeasures.

Water Pollution – Water as a scarce natural resource, Need for Water management, Measurement of Water Pollution, sourcing of water pollution, control measures of water pollution.

3. Microbiology of waste watertreatment

Waste water collection, physical, chemical and biological waste water treatment methods. Aerobic waste water treatment, Activated sludge process, Oxidation Ponds, Oxidation ditches, trickling filters, towers, rotating discs.
Anaerobic processes – Anaerobic digestion, anaerobic distillery, tannery, antibiotic industries.

4. Solid waste Management – sources, types of solid wastes, Strategies for Management (composting, wormiculture, and methane production), treatment of hazardous wastes, and Biomedicalwastes.

Biosensors - Types and applications in environmental pollution detection and monitoring.Biological indicators

5. Bioremediation of contaminated solid and wasteland-Insitu, Exsitu Bioremediation, phytoremediation

Biofertilizers – Symbiotic and asymbiotic nitrogen fixers, Benefits and limitations of Biofertilizers.

6. Microbiology of degradation of xenobiotics in environment, bioaccumulation, biodegradation of xenobiotics, Role of degradative plasmids, degradation of hydrocarbons- substituted hydrocarbons, fate of polychlorinated biphenyls, and fate of surfactants, detergents, and fate of oil spillage, bioleaching, andbiosorption.

7. Pesticides and its adverse effect on Environment. Biopesticides in integrated pest management – Preventive IPM Strategies, types ofBiopesticides.

8. Bioplastics - PHA, PHB,BIOPOL-A.
9. Biofuels - Production of Alcohols, Methane, Hydrogen from Biomass,energy crops, the future applications

Green composite – starch based. Concept of green patent.

10. Global Environmental Problems - Ozone depletion, UV-B Radiation Flux increase, effect of UVB on biological system, Greenhouseeffect, Implications of global warming, Effects and measures to control Acidrain.

References

1. Wastewater Engineering – Treatment, Disposal and Reuse. Metcalf andEddy.
2. Comprehensive Biotechnology Vol.4,M.Moo-Young.
3. Environmental Chemistry,A.K.De,
4. Introduction to Biodeterioration, D.Allsopp andK.J.Seal.
5. Comprehensive Biotechnology. Second edition, Elsevier, 2011, Murray Mor. Young (Editor in chief). ISBN-978-0-08-088504-9
6. Environmental Science and Biotechnology: A.G.Murugesan, C.Rajakumari; MJP Publishers
7. Environmental Biotechnology; Alan Scragg; Oxford University Press.
8. Environmental Biotechnology; M.H.Fulekar; Oxford & IBH Publishing Co. Pvt. Ltd.

SJGBT 2C 04 - BIOSTATISTICS AND BIOINFORMATICS

1. Population, Sample, variable, parameter, primary and secondary data, screening and representation of data. Frequency distribution, tabulation, bar diagram, histograms, per diagram, and cumulative frequency curves. Mean median, mode, quartiles and percentiles, measures of dispersion : range, variance, standard deviation , coefficient of variation, symmetry : measures of skewness and kurtosis

2. Simple linear regression and correlations.
3. Understand and interpret results from Analysis of Variance (ANOVA), a technique used to compare means amongst more than two independent populations flow charts and programming techniques in statistics with R Programming

4. Introduction to programming in BASIC : Understanding the computer – problem solving and flowcharts- Basics of Basic – constants AND variables – Expressions in Basic – Printer controls- Jumping, Branching & looping – subscripted variables. Introduction to programming in C : Overview of C – constants, variables and data types- operators and expression – Managing input and output operations- Decision making and branching – Decision making and looping – Arrays user defined functions
5. Introduction to data structures – Arrays – stacks – Queues – List operations on Arrays

   – stacks- Queues – List. Database Management System :- Characteristics of DBMS-advantages of DBMS over file processing – Actors on the scene-database models-structure of DBMS.

6. Introduction to MSEXCEL- use of worksheet to enter data, edit data, copy data, move data. Use of in-built statistical functions for computations of Mean, S.D., correlation, regression coefficients etc. Use of bar diagram, histogram, scatter plots, etc. graphical tools in EXCEL for presentation of data. Introduction to MS-WORD word processor-editing, copying moving formation, table insertion, drawing flow charts etc.
7. Computer- oriented statistical Technique : Frequency table of single discrete variable, bubble sort, computation of mean, variance and standard deviation, the test correlation coefficient.
8. Introduction to Internet and use of the same for communication, searching of database, literature, references etc.
9. Introduction to Bioinformatics, Databank search, Data management and interpretation, BLAST, Sequence alignment
10. Protein Modeling, Protein structure Analysis, Docking, Ligplot interactions, Genes, Primer designing, Phylogenetic Analysis.

References

1. Applied Bioinformatics – an introduction – (springer) Selzer P.M and others
2. Bioinformatics Basics – (CRC) – Rashidi, Hooman H , Lukas K Buchler
3. Structural Bioinformatics – (CRC) – Burkowski
4. Bioinformation a practical guide to the analysis of genes and proteins Bexevanis Andress D - ed
5. Practical Bioinformatics (springer) - Bujnicki, Janusz M.- ed
6. Biostatistics refoundation for analysis in health sciences (John wiley) Wayne W Daniel
7. Fundamentals of Biostatistics a practical approach (Kanishka) – Narenkumar Dutta
8. Statistical methods in Biology (Cambridge University Press) – Bailey, Norman T. J
9. Principles of Biostatistics (Wadsworth,USA) – Pagano Marcello.
10. Biostatistics for the biological and health sciences (Pearnon) Triola, Mare M , Triola, Mario F

SJGBT 2L 01 -LABORATARY II- METABOLISM & BASIC ENZYMOLOGY, MOLECULAR BIOLOGY AND ENVIRONMENTAL BIOTECHNOLOGY **Metabolism and Basic Enzymology (Practicals)**

I. *Extraction and purification of Enzymes. (Choose suitable enzymes)*

1. Extraction from plant tissues/Animal in suitable media and its activity measurement
2. Fractional precipitation using ammonium sulphate/ organic solvents.
3. Dialysis and desalting by gel filtration.

4. Purification by Ion exchange, adsorption chromatography and molecular sieving.
5. PAGE for the enzymes.

AI. *Enzyme assay and quantitative measurement of activation by methods such as colorimetry and spectrophotometry.*

1. Velocity measurements and calculation of specific activity.
2. Determination of optimum pH, enzyme concentration, temperature and time for enzyme activity.
3. Substrate saturation and determination of Michaelis – Menton constant
4. Determination of temperature coefficient. Determination of energy of activation.
5. Effect of inhibitors: Competitive and non-competitive inhibition. Determination of inhibitor constant.

Environmental Biotechnology (Practicals)

1) Detection of coli forms for determination of the purity of potable water.
2) Determination of dissolved oxygen concentration of water sample.
3) Determination of biological oxygen demand (BOD) of a sewage sample.
4) Determination of Chemical Oxygen demand (COD) of a sewage sample.
5) Isolation of xenobiont degrading bacteria by selective enrichment technique.
6) Survey of degradative plasmids in microbes growing in polluted environment.
7) Effect of sulphur dioxide on crop plants.
8) Estimation of nitrate in drinking water.
9) Study on biogenic methane production.

Molecular Biology

1. Preparation of Buffers – Phosphate, Acetate, Tris HCl and Borate.
2. Quantitation of Nucleic Acids.
3. DNA and RNA Agarose Gel Electrophoresis, SDS – PAGE.
4. Restriction Digestion and Ligation Experiments.
5. Isolation of Total RNA.
6. Isolation of Plasmid DNA.
7. Isolation of Genomic DNA from bacteria, plant and animal tissues.

SEMESTER-III

SJGBT 3C 01 - GENETIC ENGINEERING

1. Basic principles of genetic engineering. Scope of genetic engineering. Basic tools: restriction and modifying enzymes, Gene cloning vectors:Plasmids, Bacteriophages, Phagemids, Cosmids, Artificial chromosomes. Introduction of recombinant DNA into prokaryotic and eukaryotic systems. cDNA and genomic libraries.

Recombinant screening and selection – markers, nucleic acid hybridizations: colony, plaque, dot blot, southern and northern.

2. DNA sequencing techniques, Sanger- Coulson method, Maxam Gilbert method, Automated DNA sequencing PCR and its applications. PCR steps, Primer design Studying PCR products, Types of PCR Study of gene regulation, DNA transfection, Northern analysis, S1 mapping, Primer extension, RNase protection and Reporter assays

3. Expression vectors Expression in prokaryotic and eukaryotic systems. Antibody based screening for recombinant proteins. Expression of heterologous genes: Bacterial, Yeast, Insects Baculovirus system. Mammalian cells(Human viral vectors shuttle vector). Production of protein drugs for clinical trial

4. Processing of Recombinant proteins, Intra cellular periplasmic and extra cellular expression of protein. Purification and refolding. Characterization of recombinant proteins. Stabilization of proteins. Phage display system

5. Molecular mapping of genome. Genetic and physical maps, Chromosome microdissection and microcloning, Molecular markers in genome analysis(AFLP, RAPD, and AFLP analysis, molecular markers linked to disease resistant genes), Application in forensic, Disease prognosis, Genetic counseling, Pedigree analysis, Taxonomy and biodiversity

6. Transgenic and gene Knockout technologies, Gene therapy, Vectors and gene delivery, Gene replacement/augmentation, Gene correction, Gene editing, Gene regulation and silencing DNA Micro array technology

7. Genetic engineering guidelines, cloning and patenting of life forms Biosafety Introduction, GMOs, General Concerns, Hazards of environmental engineering, Bio-safety Guidelines and regulations Operation of Biosafety guidelines and regulations

References

1. Molecular cloning : A laboratory manual- Sambrook
2. DNA cloning: A practical approach- D.M Glover and B,D, Hames

3. Molecular and cellular methods in biology and medicine- Kaufman
4. Methods in enzymology- Vol 152: A guide to molecular cloning techniques- S.L. Berger and A.R. Kimar
5. Methods in enzymology: VOl 185: gene expression technology- D.V. Goeddel
6. DNA science: A first course in recombinant technology: D. A. Mickloss and G. A. Frier
7. Molecular biotechnology- S.B. Primrose
8. Molecular biotechnology- Glick and Pasternak

SJGBT 3C 02 - BIOPROCESS TECHNOLOGY

1. Introduction to Bioprocess engineering. The chronological development of the fermentation industryMicrobial biomass, Microbial metabolites, Recombinant products, Transformation process

2. Bioreactors: A typical bioreactor. Configuration of a bioreactor. Body construction. Aeration and agitation. Achievement and maintenance of aseptic conditions. Sterilization of fermenter, air supply exhaust gas from fermenter. Inoculation, Different ports and Probes. Valves and steam traps

3. Isolation, preservation and maintenance of microorganisms Selection of natural variants important characteristics. Screening methods Strain improvement Random mutagenesis and Site directed mutagenesis Isolation of induced mutants synthesizing improved levels of primary metabolites and secondary metabolites

4. Kinetic of microbial growth and death Batch culture Continuous culture Multistage systems Feedback systems Comparison of batch and continuous culture in industrial processes. Fedbatch culture Variable volume Fixed volume and Cyclic fed batch culture. Specific growth rate. Monod equation

5. Media for fermentation Typical media composition. Medium formulation. Carbon, Nitrogen, Minerals and Energy sources. The addition of precursors and metabolic regulators to media Medium optimization. Oxygen requirements. Antifoams. Air and media sterilization- Media and Air sterilization. Batch, continuous and Filter sterilization.

6. Types of fermentation processes Types of reactors. Analysis of batch fed batch and continuous bioreactions. Stability of microbial reactors. Analysis of mixed microbial populations. Bioreactors like pulsed, fluidized, photobioreactors, Plug flow.

7. Measurement and control of bioprocess parameters Methods of measuring Process Variables. Online Analysis of other chemical factors. Control systems.

Computer applications in fermentation technology. Mass/Oxygen transfer resistance. Aeration and agitation. Yield and energy consideration. Reynolds number and power number.

8. Downstream processing. Removal of microbial mass and solid matter. Foam separation Filtration, Precipitation, Centrifugation. Cell disruptions methods. Liquid- liquid extraction. Chromatography Membrane process. Drying and crystallization.

9. Industrial production of chemicals. Alcohol (ethanol) Acids(citric, acetic and gluconic) Solvents(glycerol, acetone and butanol) Antibiotics(penicillin, streptomycin and tetracycline) Amino acids(lysine, glutamic acid) Single cell protein Whole cell immobilization and their industrial applications

References

1. Biochemical engineering, Alba.S, Humphrey,A.Eand Millis
2. Biochemical reactors,Atkinson,B,
3. Principles of fermentation technology, Stanbury,P.F and Whitaker
4. Bioprocess technology, fundamentals and applications, KTH, Stockholm
5. Process engineering in biotechnology, Jackson, A.T., Prentice Hall, Engelwood
6. Bioreaction engineering principles, Nelson,J and Villdsen, J. Plenum Press

SJGBT 3C 03 - PLANT BIOTECHNOLOGY

1. Plant tissue culture introduction and techniques- lab organization, media preparation and types, aseptic manipulation, contamination, disease indexing anderadication,vitrification. Cell biology of plant cell culture and development-Major cell types in culture, separation of cell types, growth of cells in suspension, role of growth regulators in growth and differentiation in culture, hormone habituation.

2. Micro propagation - Principle, stages, applications.Micro propagation in commercial perspectives - advantages, economics, robotics and automation. Regeneration *in vitro*- Pathways and factors controlling regeneration. Organogenesis. Somatic embryogenesis-Induction, development and maturation, somatic embryo vs zygotic embryo, synseed production andapplications

4. Somatic hybridization-Protoplast isolation, purification, viability test, culture-conditions and media, culture methods, microcalli, regeneration, fusion methods-mechanical, chemical,selection and isolation of heterokaryons, genetic consequences, cybridization.

5. Haploid production-anther and microspore culture, pathways of androgenesis, media, factors controlling androgenesis, applications in plant breeding. Triploid production- Techniques, media, explants, organogenesis, factors affecting callus and shoot bud formation, applications in plantbreeding.Tree biotechnology – modification of wood quality.

6. Embryo culture-Types of embryo, media, role of suspensor, precocious germination, morphogenesis of undifferentiated embryo, embryo rescue, applications in plant breeding. Culture of ovule and ovary, factors affecting seed-set after *in vitro* pollination,applications.

7. Somaclonal and Gametoclonal variation-Molecular basis of variation, variants, Selection. Application in plant breeding. Mutation breeding in tissue culture-Spontaneous, induced, chimeras, adventitious bud technique. Germplasm conservation-Modes of conservation, *in vitro* methods of conservation,viability testing, applications.

8. Secondary metabolite production by plant tissue culture - Factors affecting production.Bioreactors Biotransformation, Immobilized plant cells, Hairy root cultures. Applications – Production of antibodies, viral antigens and peptide hormones in plants, biodegradable plastics in plants.

9. Plant transformation-Ti&Ri plasmids as vectors, basis of tumor formation Mechanism of DNA transfer, role of *vir*genes, binary and co-integrate vectors, viral vectors, use of 35s, inducible, tissue specific promoters, nuclear transformation, multiple gene transfer, direct gene transfer methods-macro- and micro- injection, particle gun method,electroporation, transformation ofmonocots.GM plants with animal gene – plantibodies and plant vaccines.

10. Applications of plant transformation - Herbicide resistance: phosphinothricin, glyphosphate, sulfonyl urea, atrazine; Insect resistance: Bt genes, non Bt like protease and amylase inhibitor genes,Virus resistance: coat protein mediated, nucleocapsid gene; Disease resistance: chitinase, 1-3 β-glucanase, RIP, antifungal proteins, thionins, PR proteins, Nematode resistance; Abiotic stress, Post-harvest losses, Long shelf lifeoffruits and flowers, use of ACC synthase, polygalacturonase, ACC oxidase, male sterility, carbohydrate composition and storage, ADP glucose pyrophosphate.

References

1. Bhojwani S.S and RazdanM.K. PalntTissueCulture,Elsevier,Amsterdam.
2. DeberghP.C. and Zimmerman R.H.(Eds.) 1991.Micropropagationtechnology and application,Kluwer,Dordrecht.
3. Dixon R.A. & Gonzales R.A.(Eds.) Plant cell culture-A practical approach,IRI Press,Oxford.
4. Gamborg O.L and Phillips G.C. Plant cell,tissue and organ culture.Narosa publishing house,NewDelhi, 1995.

5. Radenbaugh K.(ed.). Synseeds : application of synthetic seeds to crop improvement,CRC Press, Boca Raton, FL.
6. Chawla H.S., "Introduction to Plant Biotechnology", 3rd Edition, Science Publishers, 2009.

SJGBT 3C 04 - IMMUNOLOGY

1. Introduction to Immune system. Types of immunity- Innate, Acquired, Passive and
Active. Factors affecting Immune System.

2. Hematopoeisis and differentiation - Hematopoietic growth factors. Genetic regulation of hematopoiesis. Cells of Immune system – lymphocytes, null cells, mononuclear cells, granulocytes, dendritic cells. Organs of Immune System – primary lymphoid and secondary lymphoid organs, lymphatic system.

3. Antigens – properties- types. Immunogenicity and antigenicity. Factors affecting
immunogenecity. Antigenic epitopes, adjuvants, haptens, superantigens. Antibodiesbasicstructure, Immunoglobulin domains, antigenic determinant on immunoglobulin-isotype, allotype, idiotype, B- cell receptors (BCR) -Immunoglobulin classes and sub classes. Generation of Antibody diversity- Immunoglobulin genes.

4. Antigen – antibody interactions – Affinity and avidity, cross-reactivity, precipitation,agglutination and agglutination inhibition reactions, Hemagglutination, Bacterial agglutination and particle agglutination and its applications.

5. MHC- structure, organization and inheritance, Cellular distribution of MHC- Antigen presentation pathways- immune response, disease susceptibility, T-cell andB-cell receptors. Antigen processing and presentation. Effector responses- Humoral and Cell- mediated response. NK cell mediated cytotoxicity, Antibody dependent cellmediated cytotoxicity, macrophage mediated cytotoxicity. Regulation of immuneresponse. Activation of B and T lymphocytes.

6. Cytokines- Properties and therapeutic use- cytokine secretion by TH1 and TH2 cells - Cytokine related diseases : Bacterial septic- shock, chaga‟s

disease ,lymphoid and myeloid cancers. Complement system- Pathways- Role in
immune regulation.

7. Hypersensitivity – types. Diagnosis and treatment approaches Autoimmunity and
Autoimmune diseases – Organ specific :thyroid and Systemic: SLE Diagnosis and
treatment approaches

8.Immunity to infectious agents – viral, bacterial, protozoan and helminthesinfections.Immune aversion mechanisms.

9. Transplantation immunology – Tissue and organ transplantation. Immunology of
rejection-mechanism, Immunosuppressive agents, Tumor Immunology – Oncogenes
and cancer induction. Tumor antigens and immune response. Cancer immunotherapy

10.Vaccines: Active and passive immunization. Whole organism vaccines, Recombinant vector vaccines, DNA vaccines, Synthetic peptide vaccines, Multivalent vaccines - Hybridoma technology - Monoclonal antibodies and therapeutic applications

References

1.Godkar, P.B (1998): A Text Book of Medical LaboratoyTechnology.Bhalani
Bhalani Publishing House Mumbai.
2.JanisKuby (2000) .Immunology.7th ed. W.H. Freeman& Co. New York.
3.Chakraborty ,A.K.(2006).Immunology and Immunotechnology.Oxford University Press.
4.Peter Parham (2004): The immune system (Second edition, Garlands, New
York).
4. Eli Benjamini, Richard Coico, Geoffrey Sunshine (2000)Immunology – A short course Wiley,– New York ; Chichester :
5. William Paul (2012)Fundamentals of Immunology –Wolters Kluwer, Luppincott, Williams & Wilkins
6. David Male,Jonathan Brostoff, David Roth& Ivan Roitt(2012)- Immunology- Saunders

SJGBT 3E 01 Stem Cell Biology (*PART-A)*

Unit. I - Introduction to stem cells, classification, Sources, programming and reprogramming, tissue specific stem cells Embryonic hematopoietic and neural stem cells, Classification and Sources

Unit II - Embryonic Stem Cells Blastoyst and inner cell mass cells; Organogenesis; Mammalian Nuclear Transfer Technology; Stem cell differentiation; Stem cells cryopreservation

SJGBT 3E 02 Virology Part A

Unit I General properties of viruses- Structure and Morphology, Cultivation. Methods used for viral quantification and enumeration. Electron-microscopic studies Viral classification DNA and RNA viruses, Laboratory requirements for cultivation. Lawn culture, Embryonated egg inoculation, Animal inoculation, Permissive and non-permissive hosts or cells. Tissue - Types of cell-lines used for the study Detection of virus growth in cell culture

UnitIIViral Tropism, Factors responsible for viral tropism. Replication of DNA viruses and RNA viruses, effects of viruses on the host cells – cyto-pathic effect. Immune aversion mechanism of viruses, Emerging viral diseases. Virus Host interaction- Acute infection, chronic/persistent infection latent infection and slowly progressive virus infection Viral inclusion bodies - methods of staining and demonstration.

SJGBT 3L 01-LABORATARY III- GENETIC ENGINEERING, BIOPROCESS TECHNOLOGY, PLANT BIOTECHNOLOGY AND IMMUNOLOGY

Genetic Engineering (Practicals)

1. Preparation of competent cells
2. Calcium Chloride mediated transformation of *E. coli*
3. Shot- gun cloning in plasmid or phagemid vectors
4. Southern blotting
5. Northern blotting
6. PCR
7. Repoter gene assay(Gus/CAT/b-GAL)

Bioprocess Technology (Practicals)

1 Isolation of industrially important microorganisms for microbial processes
2. Comparative studies of ethanol production using different substrates
3. Microbial production of citric acid using *Aspergillus niger*
4. Microbial production of antibiotics(penicillin)
5. Production and estimation of Protease
6. Use of alginate for cell immobilization

Plant Biotechnology (Practicals)

1. Preparation and sterilization of glasswares, explant.
2. Preparation stock solution for and media.
3. Large scale isolation of mesophyll cells from leaves.
4. Initiation and maintenance of callus.
5. Organogenesis from callus
6. Somatic embryogenesis from root cultures.
7. Induction of haploids from anther and pollen cultures
8. Cultures.Isolation and culture of protoplasts from leaf/callus by
9. Quantitation of tissue culture procedures: Determination of fresh and dry weights, cell culture density, PCV and MI

Immunology (Practicals)

1. Blood film preparation and identification of cells, ABO Blood grouping.
2. Lymphoid organs and their microscopic organization.
3. Immunization and collection of Serum.
4. Antibody titration.
5. Double immunodiffusion, Radial Immunodiffusion and immunoelectrophoresis.
6. Western Blotting.
7. ELISA.
8. Separation of mononuclear cells by Ficoll – Hypaque and its cell culture by mitogen induction.
9. Widal and VDRL tests

SEMESTER-IV

Elective Course

SJGBT 4E 03 Stem Cell Biology **(***PART-B)*

Unit III = Application of stem Cells Overview of embryonic and adult stem cells for therapy Neurodegenerative diseases; Parkinson's Alzheimer, Spinal Code Injuries and other Brain Syndromes; Tissue systems failures; Diabetes; Cardiomyopathy; Kidney failure; Liver Failure; Cancer; Hemophilia.

Unit IV - Human Embryonic Stem Cells and society. Human stem cells research: Ethical considerations; Stem cell religion consideration; Stem cell based therapies: Pre clinical regulatory consideration and Patient advocacy.

Unit V - Various model organisms. Stem cell isolation &characterization techniques

References

1. Ann A Kiessling, Human Embryonic Stem Cells: An Introduction to the Science and Therapeutic Potential, jones and Bartett, 2003.
2. Peter J. Quesenberry, Stem Cell Biology and Gene therapy, 1st Edition, Willy-Less, 1998.
3. Robert Lanja, Essential of stem cell Biology, 2nd Edition, Academic Press, 2006.
4. A.D. Ho., R. Hoffiman, Stem Cell Transplantation Biology Processes Therapy, Willy-VCH, 2006.
5. C.S. Potten, Stem Cells, Elsevier, 2006.

SJGBT 4E 04 Virology Part B

-

Unit III Animal viruses Poxviruses, Papilloma Viruses, Human Herpes Viruses, Adenoviruses, Picornaviruses, Rotaviruses, Retroviruses, Flaviviruses, Coronaviruses Human Swine fever virus Cancer causing RNA and DNA Viruses. Viral arthritis. Control of animal viral diseases, Antiviral agents, Combination therapy, Nucleic acid based therapies

Unit IV

Bacteriophages Lambda phage, T phages, Filamentous phages M 13 phages.Lytic and lysogenic cycles of Lambda phage. M13 replication Types of plant viruses, Economic losses due to important viruses;DNA viruses, RNA viruses, satellite viruses, viroids, virusoids; Disease symptoms, local and systemic movement of viruses, plasmodesmata and virus movement.

Unit V

Virus detection and diagnosis; Infectivity assays- Sap transmission, insect vetor transmission, agroinfection (using Agrobacterium); Ultracentrifugation, electron microscopy, serological methods, immunelectrophoresis in gels, direct double-antibody sandwich method, Dot ELISA, Immunosorbent electron microscopy (ISEM), Nucleic acid based viral detection.

Texts/ References

Ed. C.L. Mandahar, Molecular biology of Plant viruses, Kluwer academic publishers, Dordrect, 1999.

Roger Hull (Ed), Mathews Plant Virology, 4th Edition, Academic Press, San Diego, 2002.

D.G.A. Walkey (Ed), Applied Plant Virology, 2nd Edition, Chapman & Hall, London, 1991.

Text Book of Microbiology :Ananthanarayanan& JayaramPanikker

Medical Virology : Fenner and White

Principles and Practice of Infectious diseases – Madell, Bennett, Dolin Vol- 1 & 2

Medical Microbiology : David Greenwood, Slack, Peutherer

Essentials of Diagnostic Virology: G. Storch

Notes on Medical Virology ByMorag.C. Timbury

Diagnostic methods in Clinical Virology : N.R. Grist

Fundamentals of Molecular Virology By Nicholas H. Acheson

SJGBT 4E 05 Industrial & Food Biotechnology

Unit I Industrial and Food Biotechnology; Indroduction; History; Importance; Applications of Bioprocess and Biotechnology in food processing; Significant advances; Risk factors; Safety regulations.

Unit II Bioprocessing - Industrial use of microorganism; Microbes exploited commercially - Saccharromyces, Lactobacillus; Penicillium, Acetobactor, Bifidobacterium, Lactococcus, Streptococcus. Fermentation-process, media and systems; Upstream and down stream processing; Product development; Dairy fermentationand fermented products.

Unit III Microbial enzymes in food processing; Industrial production of enzymes – proteases amylase, invertase, pectinase and cellulases; High Fructose Corn Syrup (HFCS). Food and beverage fermentation-alcholic and non alcoholic beverages; Food additives and supplements

– probiotics, health care products, Neutraceuticals, vitamins and antibiotics, Fuels and industrial chemicals-Alkanes, industrial ethanol.

Unit IV Modification of microbes/enzymes – Strain improvement, enzymes/cofactors recombinant enzymes, Applications in product development/improvement.

Unit V Cells and enzymes immobilization. Product enhancement – Classic examples; Biosensors and Bioprocess monitoring; Basic components and the utility and applications. Texts/References

1. Gautam, N.C., Food Biotechnology in Comprehensive Biotechnology, Vol.6., Shree Publishers,
2. Gutierrez – Lopez, G.F. et. Al., Food Science and Foos Biotechnology. CRC Publishers, Washington, 2003
3. Maheshwari, D.K. et. Al., Biotyechnological applications of microorganisms, IK. International, New Delhi, 2006
4. Stanbury, P.F. et. al., Principles of Fermentation Technology, 2nd Edition, Elsevier, UK, 1995.
5. Waites, M.J. et. al., Industrial Biotechnology: An Introduction, Blackwell publishing, UK, 2007.
6. Food Microbiology, William C. Fraizer & Deniss C Westhoff, Tata MaGraw-Hill, 2008.
7. Industrial Microbiology Casida L. E., Wiley, 2007

SJGBT 4E 06- Nanobiotechnology

Unit I - Introduction to Nano-Biotechnology; Nanotechnology definition and concepts; Cellular Nanostructures; Nanoprocess; Biomolecular motors; Criteria for suitability of nanostructures for biological applications

Unit II - Molecular nanotechnology; Nanopowders and nanomaterials: Sol-gels and their use, Use of natural nanoparticles, Nanobiometrics, Lipids as nano-bricks, Proteins as nanomolecules, DNA in nanotechnology, Present and future of nanotechnlogy applications in Molecular biology and Medicine

Unit. III - Basic characterization techniques; Electron microscopy; Atomic force microscopy; Photon correlation sepectroscopy, Thin films; Colloidal nanostructures; Nanovesicles; Nanospheres; Nanocapsules

Unit IV - Nanostructures for drug delivery, concepts, targeting, routes of delivery and advantages

Unit V - Nanostructures for diagnostics and biosensors; Nanopartcles for diagnostics and imaging; Nanodevices for sensor development.

References

1. Multilayer Thin Films, Editors(s): Gero Decher, Joseph B. Schlenoff, Multilayer Thin Films, Wiley-VCH Verlag, GmbH & Co. KGaA ISBN: 3527304401
2. Bionanotechnology: Lessons from Nature Author: David S. Goodsell Publisher: Wiley-Liss ISBN: 047141719X.
3. Biomedical Nanotechnology Editor: Neelina H. Malsch Publisher: CRC Press ISBN: 0-8247-2579-4
4. Gero Decher, Joseph B. Schlenoff, Multilayer Thin Films, Wiley-VCD Verlag, GmbH & Co.KGaA, 2003.
5. David S. Goodsell, Bionanotechnology: Lessons from Nature, 1st Edition, Wiley-Liss, 2004.
6. Neelina H. Malsch, Biomedical Nanotechnology, 1st Edition, CRC Press, 2005.

GENERAL PATTERN OF QUESTION PAPER FOR CORE AND ELECTIVE COURSES IN GENERAL BIOTECHNOLOGY

ENVIRONMENTAL BIOTECHNOLOGY

Time: Two and half hours

Max. Weight : 30 weightage

Section- A

Answer any four questions. Each question carries a weightage of 2 - **(4 x 2 = 8)**

1. Differentiate between BOD and COD
2. What are Biosensors and its application
3. Give an account on biological indicator species
4. What are oxidation lagoons
5. Concept of green patent
6. Write the important features of UASB
7. Comment on Ozone depletion

Section B

Answer any four questions. Each question carries a weightage of 3 - **(4 x 3 = 12)**

8. Explain the hazardous effects of xenobiotics
9. Biofuels.
10. Discuss the role of microorganisms in the degradation of pesticides.
11. Bioplastics.
12. Write notes on Vermicomposting
13. Biochemistry of Lignin biodegradation
14. Working of Trickling filter.

Section C

Answer any two questions. Each question carries a weightage of 5 - **(2 x 5 = 10)**

15. Describe the tertiary treatment strategies for waste water.
16. Explain degradation of xenobiotics using microbes
17. Describe various strategies for management of solid waste
18. Discuss sources and controlmeasures for air pollution
